



US009283701B2

(12) **United States Patent**
Doan et al.

(10) **Patent No.:** **US 9,283,701 B2**
(45) **Date of Patent:** **Mar. 15, 2016**

(54) **IN-MOLD DECORATIVE APPLIQUE WITH TEXTURED SURFACE**

(75) Inventors: **Linh N. Doan**, Belleville, MI (US);
James P. Holland, Brighton, MI (US);
Kenneth S. Laird, Canton, MI (US);
Stacy L. Swank, Auburn Hills, MI (US);
Jeffrey B. Crist, Sterling Heights, MI (US);
Warwick J. Smith, Grosse Pointe Woods, MI (US);
Aileen N. Barraza, Canton, MI (US)

(73) Assignee: **FORD GLOBAL TECHNOLOGIES, LLC**, Dearborn, MI (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1181 days.

(21) Appl. No.: **12/841,221**

(22) Filed: **Jul. 22, 2010**

(65) **Prior Publication Data**
US 2012/0021182 A1 Jan. 26, 2012

(51) **Int. Cl.**
B29C 45/14 (2006.01)
B29C 45/37 (2006.01)
B32B 3/10 (2006.01)

(52) **U.S. Cl.**
CPC **B29C 45/1418** (2013.01); **B29C 45/372** (2013.01); **B32B 3/10** (2013.01); **B32B 2605/003** (2013.01); **Y10T 428/24612** (2015.01)

(58) **Field of Classification Search**
CPC **B29C 45/1418**; **B29C 45/372**; **B32B 3/10**; **B32B 2605/003**; **Y10T 428/24612**
USPC **428/172**
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,514,458 A	5/1996	Schulze-Kadelbach et al.
RE36,457 E	12/1999	Ellison et al.
6,019,923 A	2/2000	Pelzer
7,555,157 B2	6/2009	Davidson et al.
7,784,846 B2 *	8/2010	Vasko et al. 296/39.1
2007/0026201 A1 *	2/2007	Botrie et al. 428/195.1
2007/0269671 A1	11/2007	Hirschfelder et al.
2008/0073813 A1 *	3/2008	Smith et al. 264/266
2010/0007045 A1	1/2010	Hsu et al.
2010/0013260 A1 *	1/2010	Vasko et al. 296/70
2010/0148530 A1	6/2010	Michler

OTHER PUBLICATIONS

Author Unknown. Definition of 'Node'. Jul. 15, 2012. Available online at <http://dictionary.reference.com/browse/node>.*

* cited by examiner

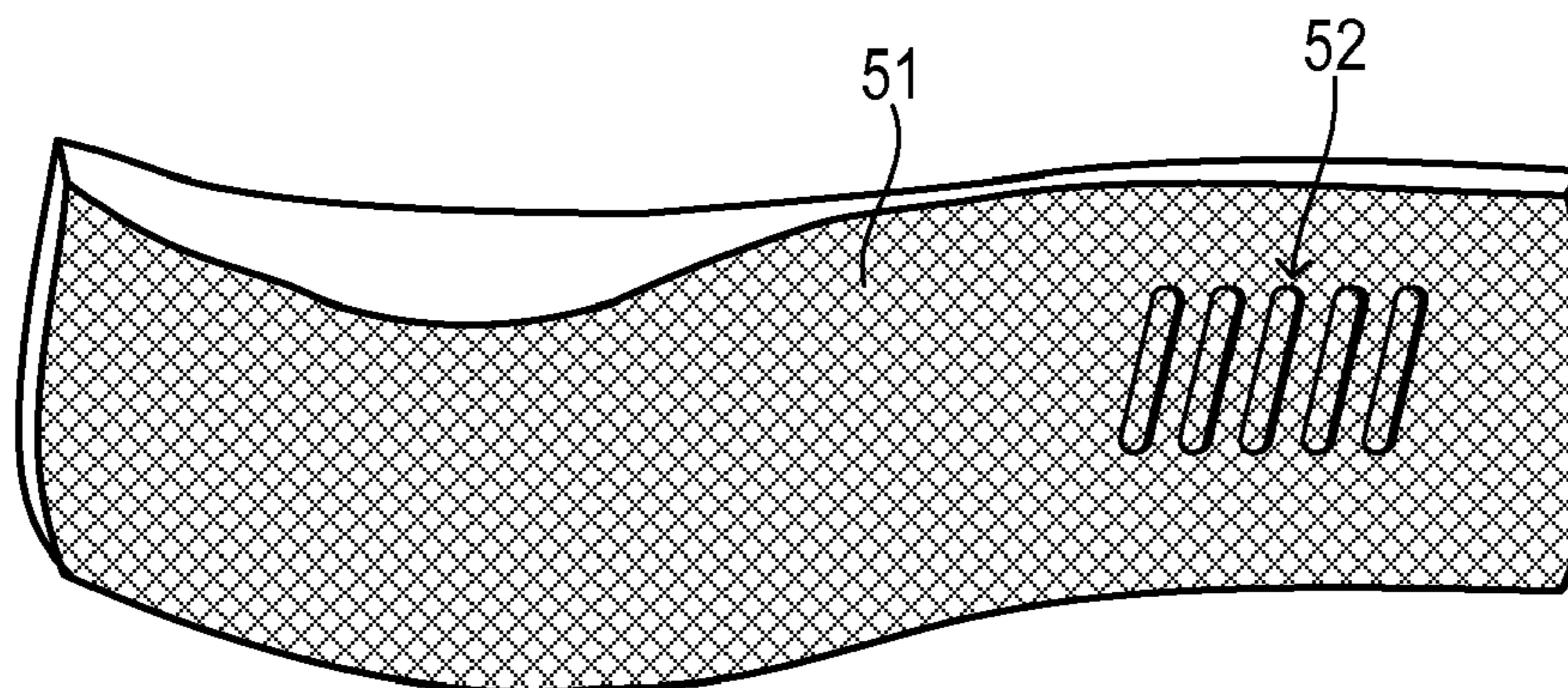
Primary Examiner — Nathan Van Sell

(74) *Attorney, Agent, or Firm* — Vichit Chea

(57) **ABSTRACT**

A plastic-molded automotive interior trim component has a curvilinear finished surface with a relatively flat portion and a relatively curved portion. A decorative film subcomponent has an outer surface and an inner surface, wherein at least the outer surface is pigmented with a desired color of the finished surface. Prior to incorporation into the plastic molded component, the decorative film subcomponent has a shape generally conforming to the curvilinear finished surface and is substantially smooth. A structural backing member is in-mold laminated with the decorative film subcomponent, wherein the structural backing member is formed by injection molding a backing material against the inner surface of the decorative film subcomponent in a mold having a film-receiving surface with a three-dimensional texture that receives the decorative film subcomponent. The texture shapes the decorative film subcomponent with an embossed pattern having a substantially uniform, undistorted appearance on at least part of the relatively flat portion and at least part of the relatively curved portion.

6 Claims, 5 Drawing Sheets



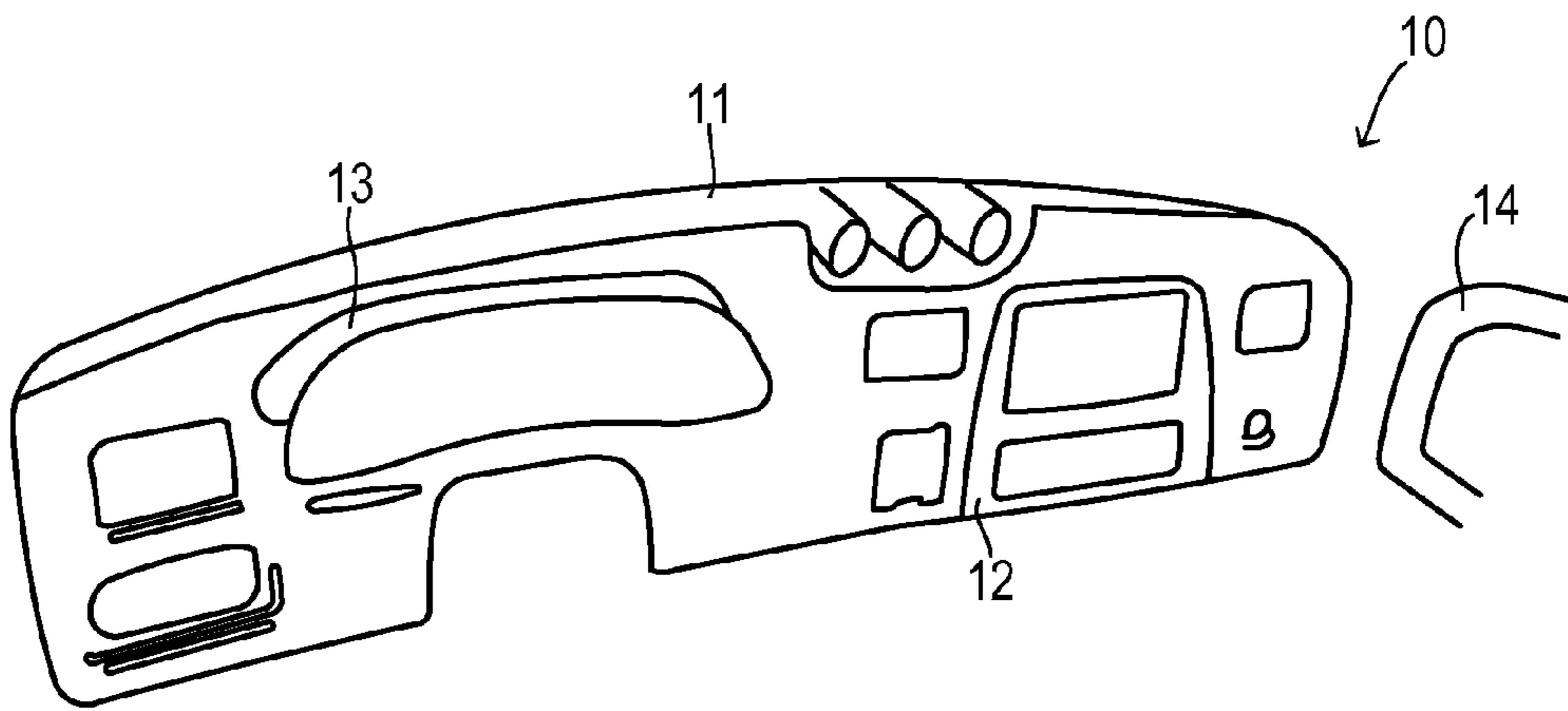


Fig. 1

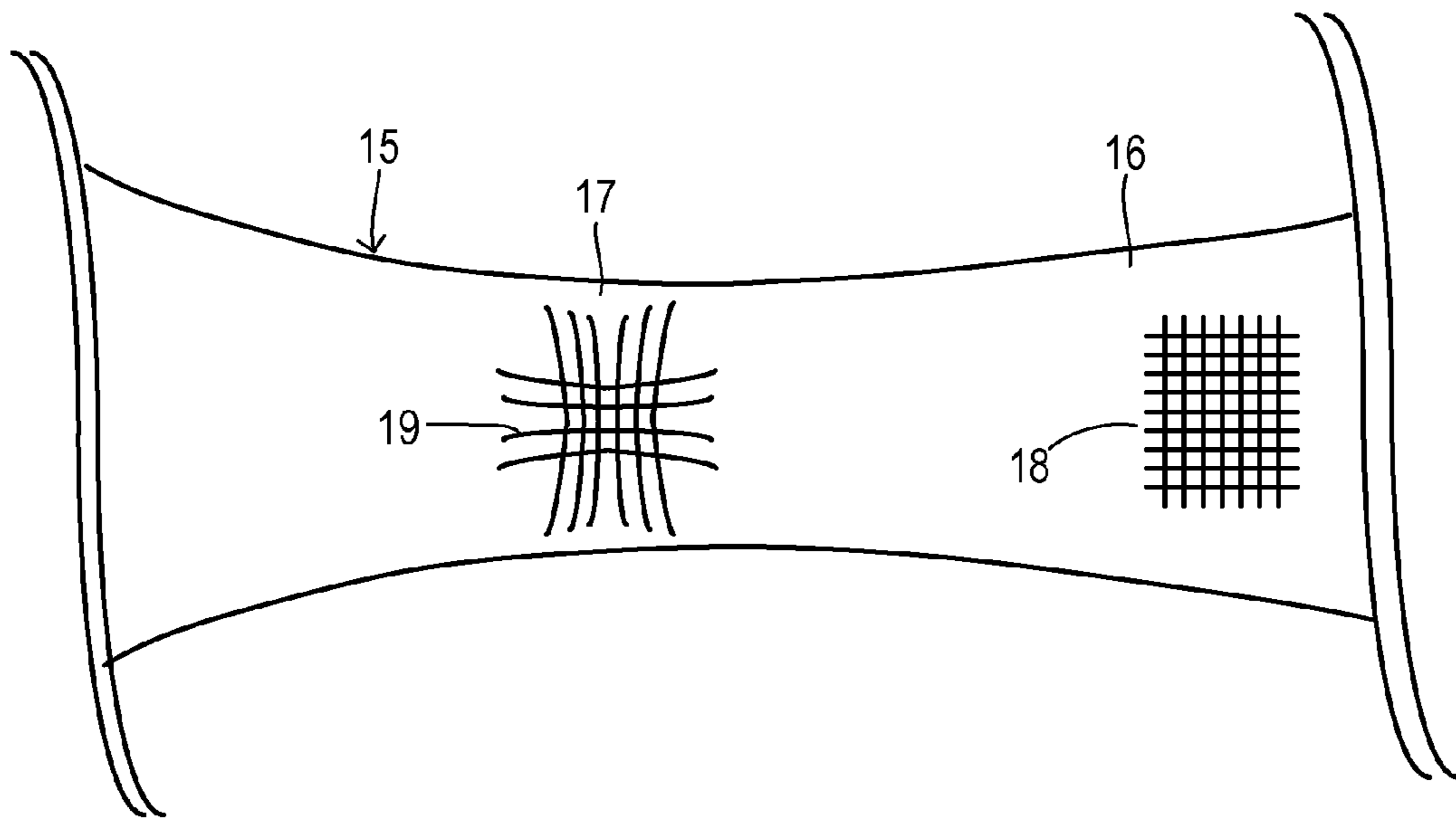
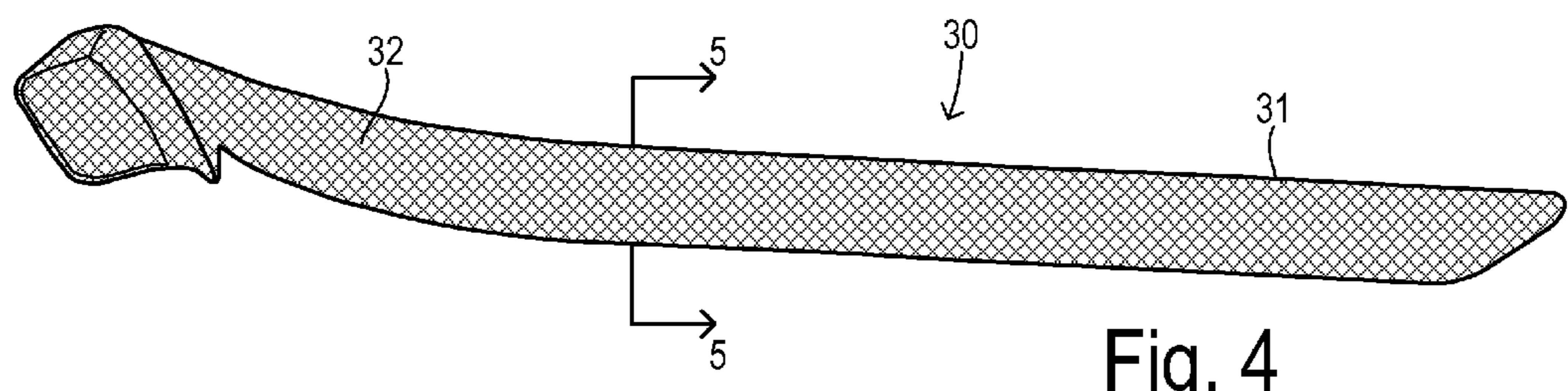
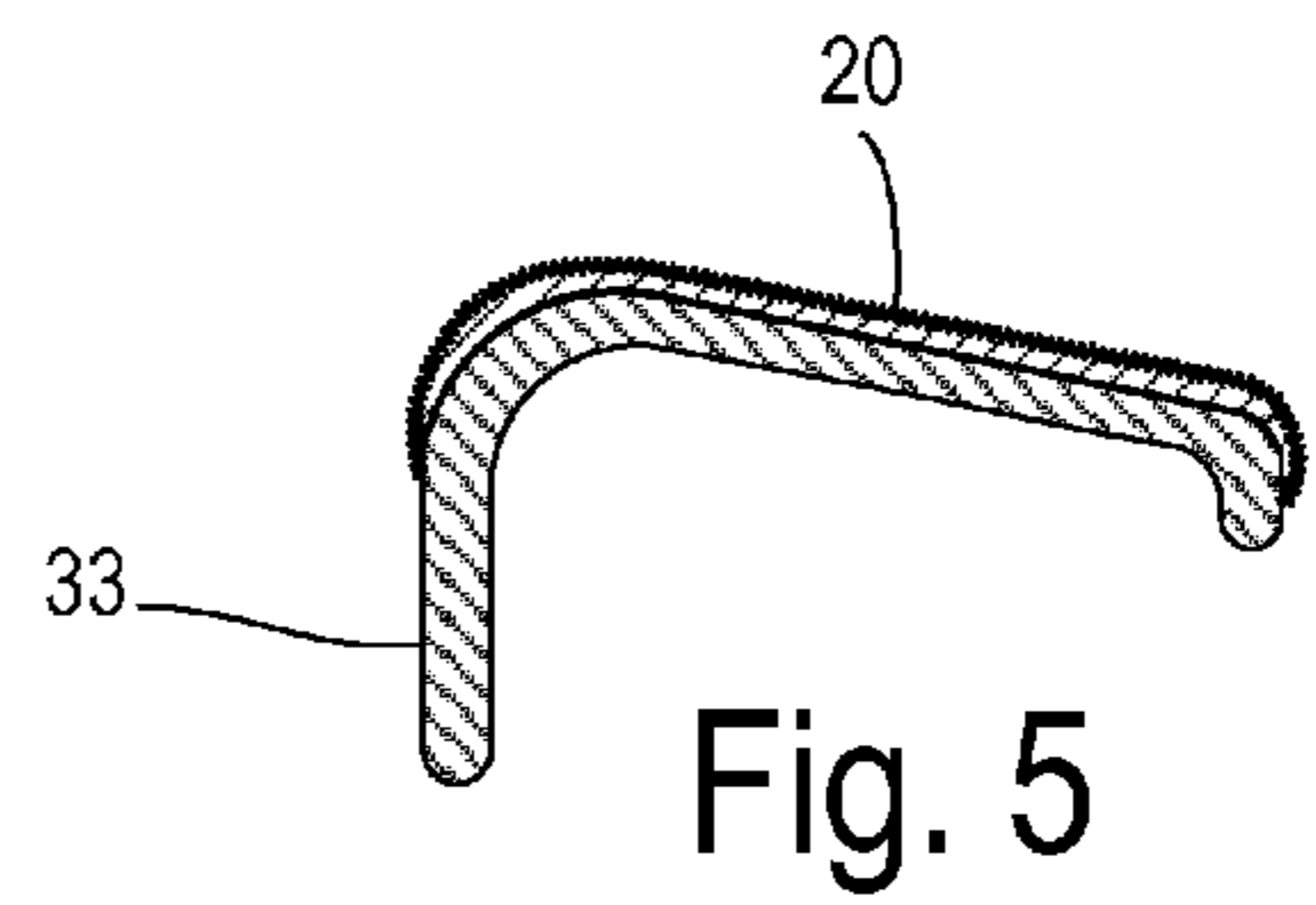
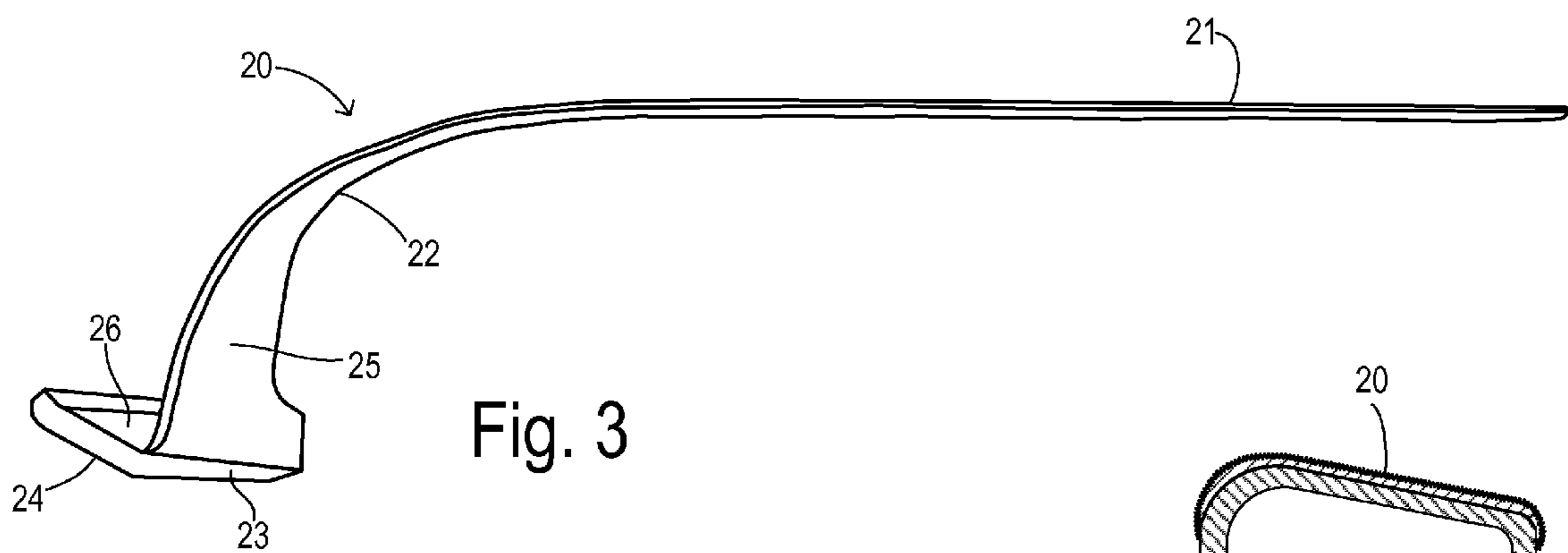


Fig. 2



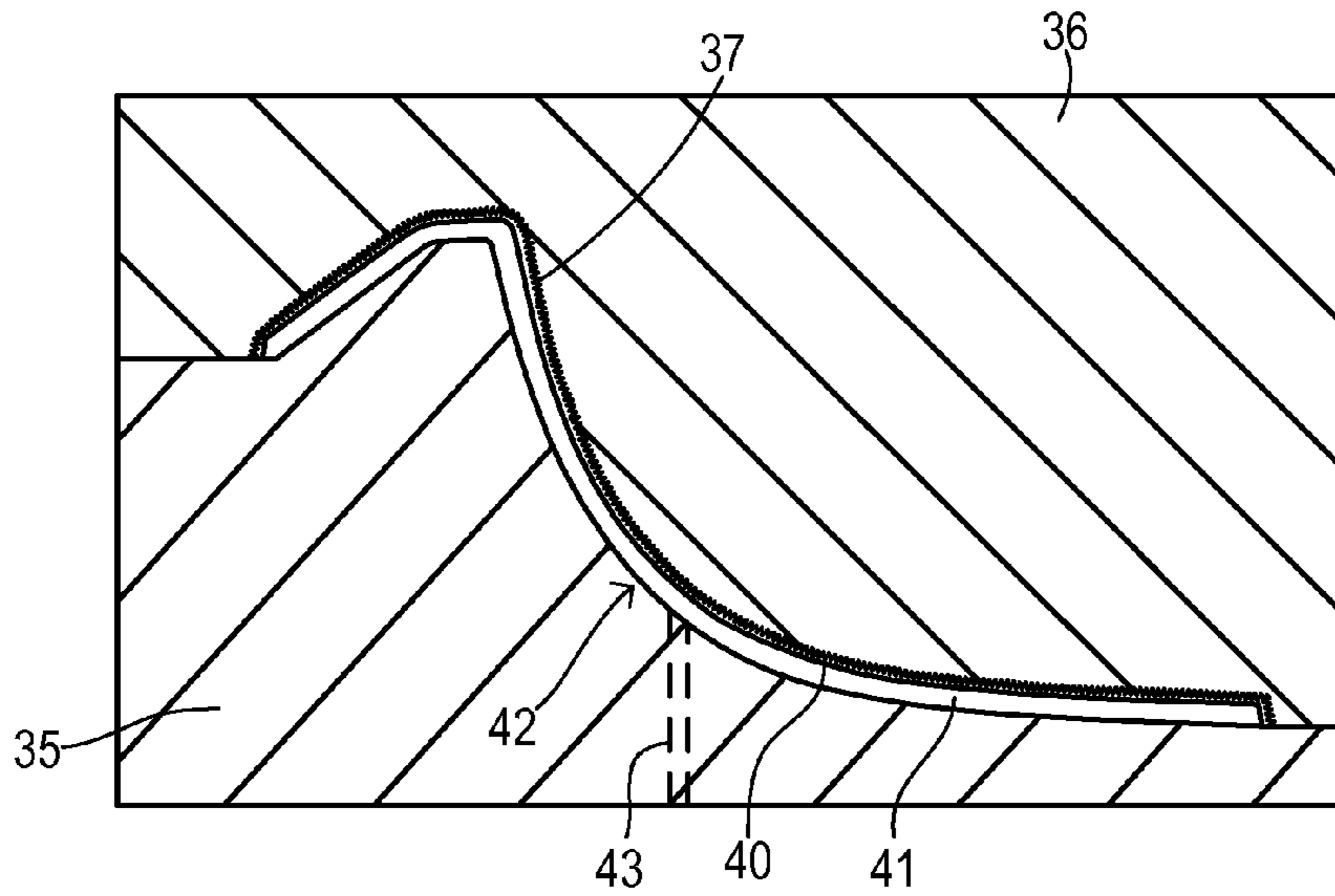


Fig. 6

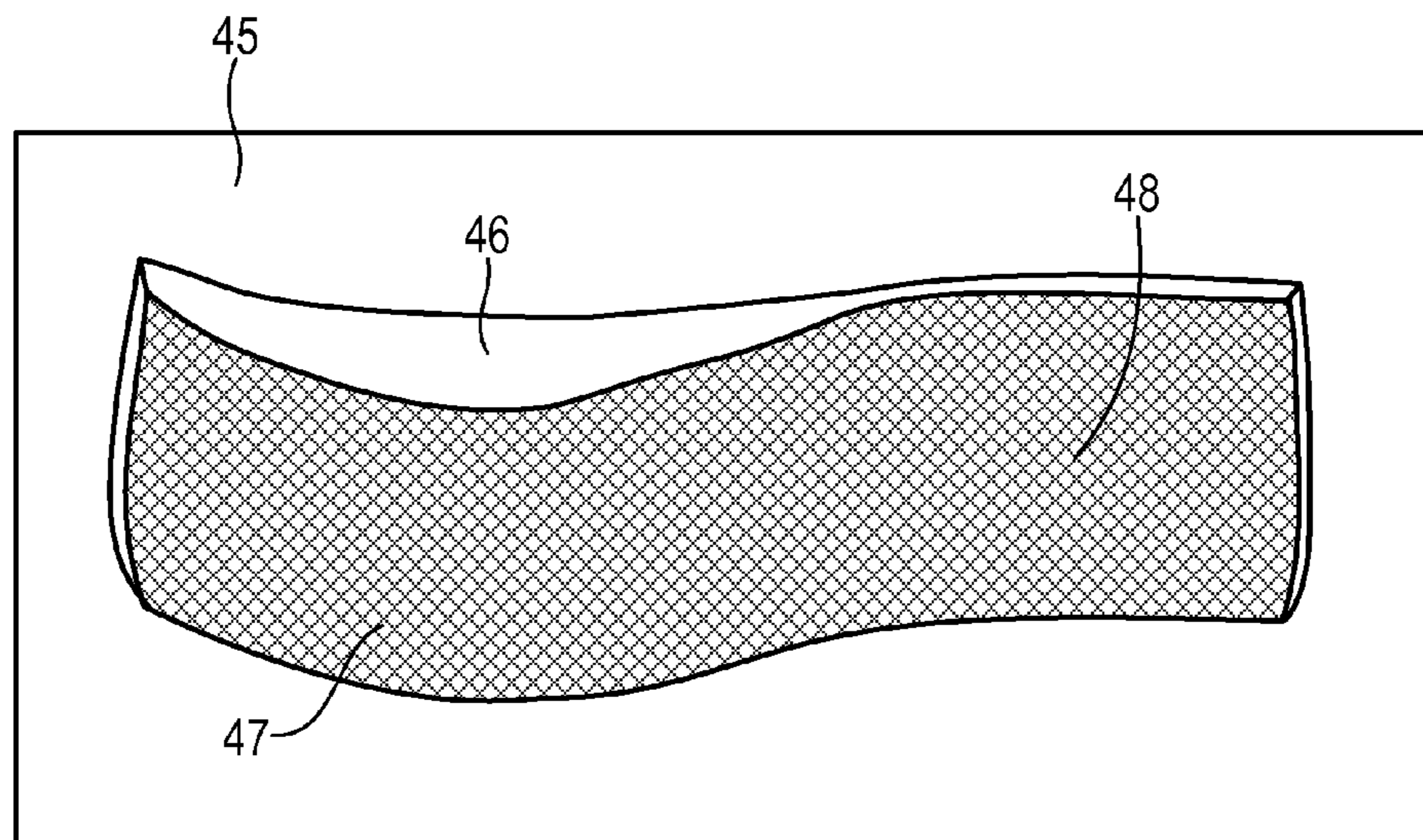


Fig. 7

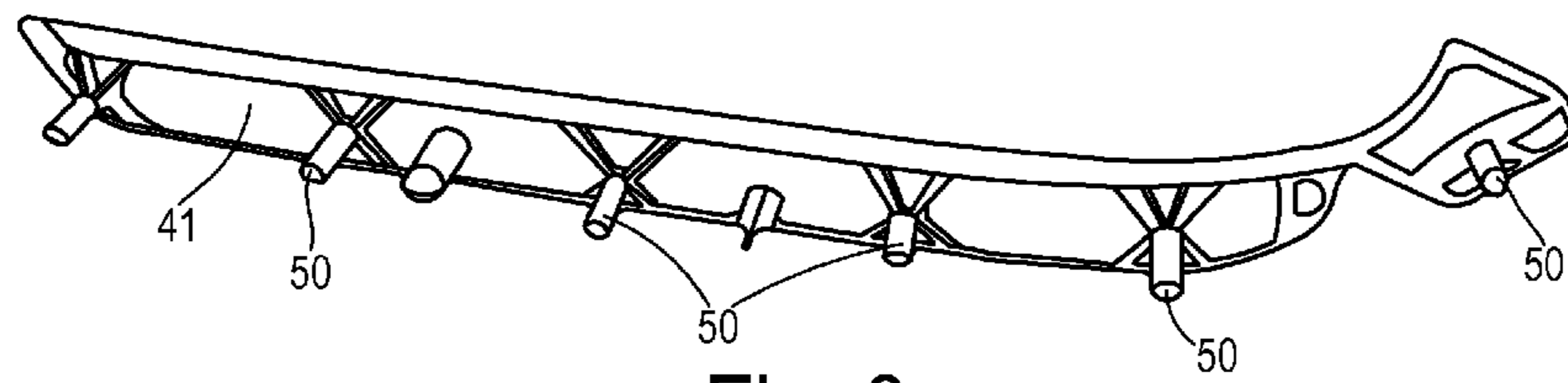


Fig. 8

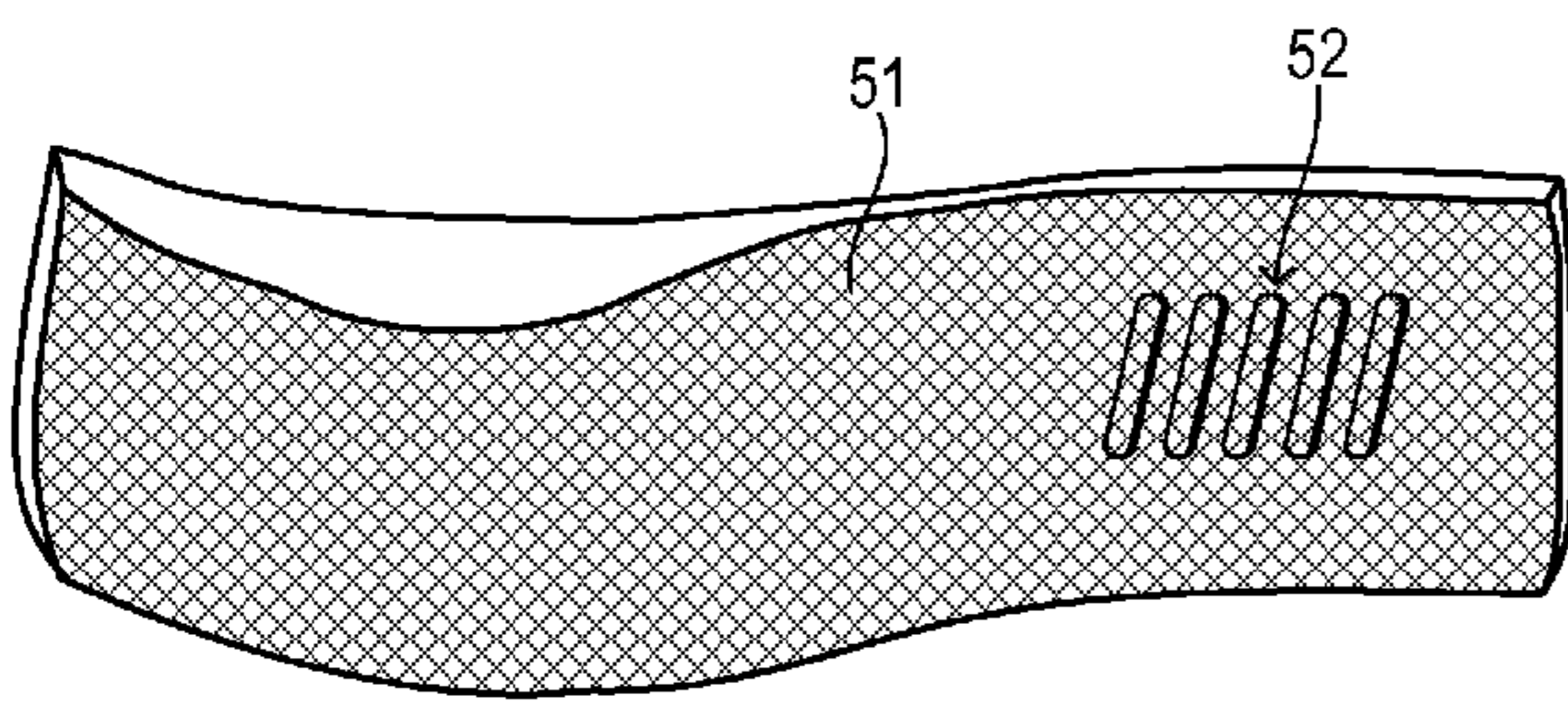


Fig. 9

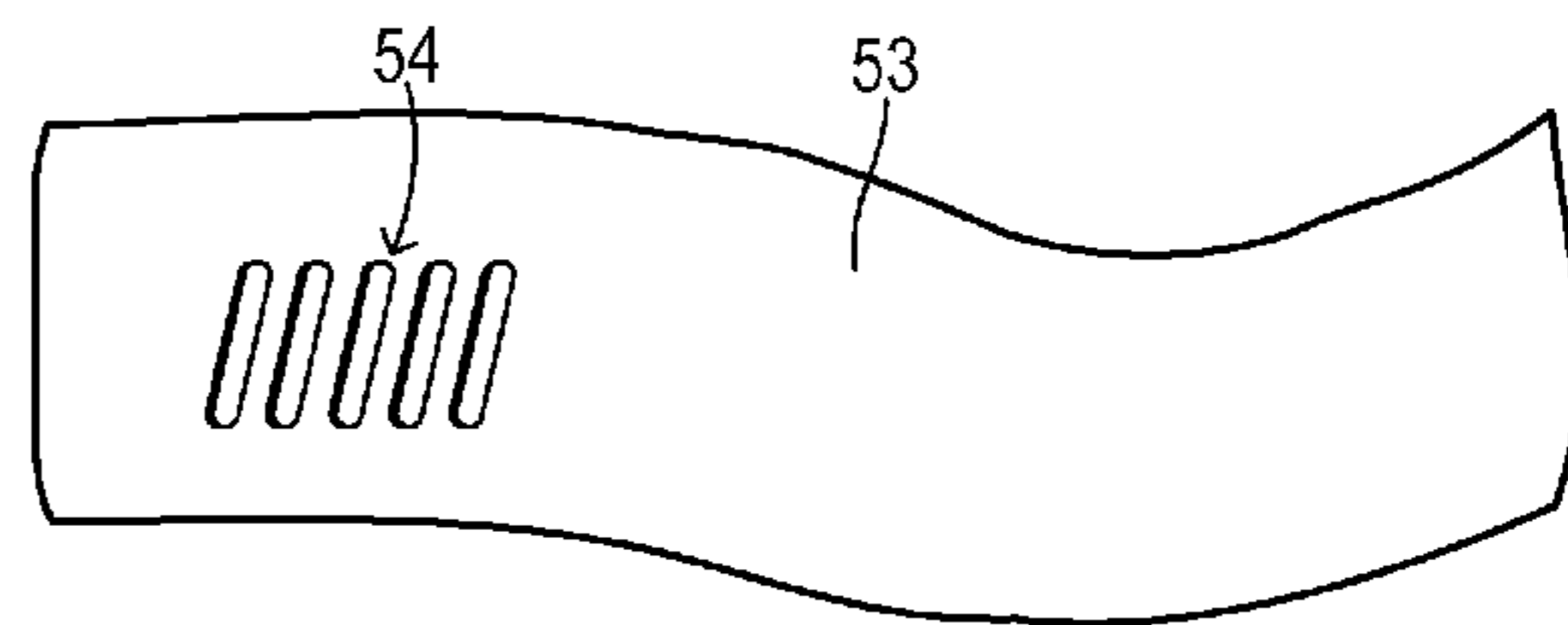


Fig. 10

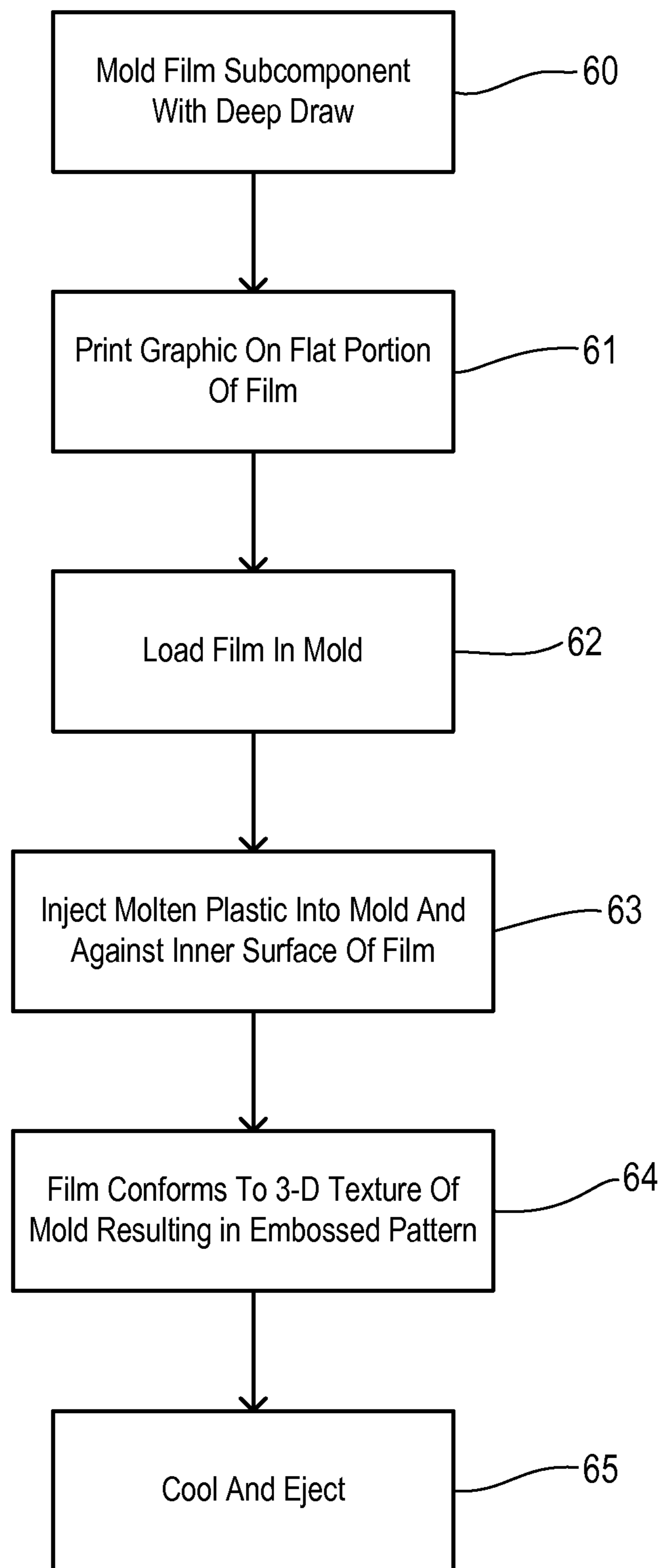


Fig. 11

1**IN-MOLD DECORATIVE APPLIQUE WITH
TEXTURED SURFACE****CROSS REFERENCE TO RELATED
APPLICATIONS**

Not Applicable.

**STATEMENT REGARDING FEDERALLY
SPONSORED RESEARCH**

Not Applicable.

BACKGROUND OF THE INVENTION

The present invention relates in general to molded automotive interior trim components, and, more specifically, to a decorative appliqué having an embossed pattern.

Interior trim systems for automotive vehicles typically include multiple trim sections mounted to various support structures in the vehicle. Some sections are abutting to give a substantially continuous surface, and others may be mounted remotely within a passenger cabin. Such trim systems may include instrument panels with multiple abutting sections, door trim systems, and ceiling trim. The interior trim components may provide various functions and are styled according to various decorative shapes and surface treatments.

A typical interior trim component comprises a plastic-molded part formed as an in-mold lamination, wherein a visible surface of the trim component is formed from a film or appliqué which is itself a thin molded plastic part with a pigment (e.g., paint or dye) layer on its outer side. The appliqué is placed in another mold where a structural backing member is injection molded against the appliqué resulting in a structurally rigid component with a desired decorative treatment on the visible surface.

Some interior trim components may include a curving or twisting surface, such as at the corners or other boundaries of an instrument panel. During molding of the appliqué/film, highly curved surfaces are typically formed using a deep draw mold process wherein a vacuum pulls an initially flat sheet onto a curved mold surface while being heated.

For styling purposes, it may be desired to utilize an appliqué having other than a monotone colored surface. For example, a printed or silk-screened ink pattern may be applied to the appliqué in order to provide a visually interesting surface. However, the pattern is most easily applied to the appliqué while it is a flat sheet and prior to molding into its approximate final shape. During deep drawing for forming a highly curved surface, the printed pattern distorts as the film stretches to conform with the deep draw mold. Consequently, the resulting pattern is not uniform, and the distorted appearance of the resulting trim component is undesirable.

SUMMARY OF THE INVENTION

In one aspect of the invention, a plastic-molded automotive interior trim component has a curvilinear finished surface with a relatively flat portion and a relatively curved portion. A decorative film subcomponent has an outer surface and an inner surface, wherein at least the outer surface is pigmented with a desired color of the finished surface. Prior to incorporation into the plastic molded component, the decorative film subcomponent has a shape generally conforming to the curvilinear finished surface and is substantially smooth. A structural backing member is in-mold laminated with the decorative film subcomponent, wherein the structural backing

2

member is formed by injection molding a backing material against the inner surface of the decorative film subcomponent in a mold having a film-receiving surface with a three-dimensional texture that receives the decorative film subcomponent.

5 The texture shapes the decorative film subcomponent with an embossed pattern having a substantially uniform, undistorted appearance on at least part of the relatively flat portion and at least part of the relatively curved portion.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view showing an interior trim system for an automotive vehicle.

FIG. 2 is a plan view of an appliqué using surface printing that is distorted as a result of a deep draw mold.

FIG. 3 is top view of a curved appliqué of the invention.

FIG. 4 is a front view showing a finished trim component using the appliqué of FIG. 3.

FIG. 5 is a cross-section of the trim component along lines 5-5 of FIG. 4.

FIG. 6 is a cross-sectional view of an interior trim component of the invention while in a mold.

FIG. 7 shows an example of a film-receiving mold surface according to one embodiment of the present invention.

FIG. 8 is a rear, perspective view of a trim component.

FIG. 9 shows a mold surface having an optional relief section.

FIG. 10 shows an appliqué with a printed graphic corresponding to the relief section.

FIG. 11 is a flowchart showing a preferred method of the present invention.

**DETAILED DESCRIPTION OF PREFERRED
EMBODIMENTS**

Referring now to FIG. 1, an interior trim system 10 is an example of a typical system having multiple trim components. Abutting trim components 11-13 provide interior trim surfaces for an instrument panel or dashboard. A door trim panel 14 typically has a consistent appearance with the instrument panel even though it is not abutting. While some components may be relatively flat (e.g., trim component 12), other components (e.g., components 11 and 13) have a curvilinear finished surface that may include both relatively flat portions and relatively curved portions. Since patterns applied to the decorative appliqués for deep drawing into a curved trim component would result in an undesirable distorted appearance, a smooth monotone surface treatment has been used for any such curved components. Since a consistent appearance across the entire trim system is desired, the same monotone surface treatment was usually required for the relatively flat components as well.

FIG. 2 shows a prior art appliqué 15 with a relatively flat portion 16 and a relatively curved portion 17. A regular grid pattern (a portion of which is shown at 18) is printed over the entire sheet of appliqué 15 prior to molding. The deep draw molding of appliqué results in a distorted appearance as shown at 19. The present invention seeks to extend the undistorted appearance of the pattern into the deep drawn, relatively-curved portion, thereby allowing greater flexibility in the patterning of surface treatments for the entire interior trim system.

As shown in FIG. 3, an unprinted decorative film subcomponent 20 may be used in the present invention. Film 20 may be conventionally deep draw molded with a relatively flat portion 21 and a relatively curved portion 22. A further curved portion 23 is contiguous with another flat portion 24. Sub-

3

component **20** has an outer surface **25** and an inner surface **26**. Preferably, outer surface **25** is substantially smooth. The overall shape of film subcomponent **20** is molded to approximately conform to a curvilinear finished surface of the finished interior trim component. For purposes of the present invention, conforming means that it is sufficiently close to its final shape to allow it to be placed into a final mold in which it will be in-mold laminated with a structural backing member by injection molding as is known in the art.

Outer surface **25** is smooth and monotone, although relatively flat portion **21** may also include graphic printing or other contrasting pigmentation as described later. At least outer surface **25** is pigmented with a desired color for the finished surface. The pigmentation may be from a paint or a dye, for example. Subcomponent **20** may be layered with the pigment being in only to outer surface **25**, with other materials such as an adhesive forming inner surface **26**.

In order to provide a substantially uniform, undistorted pattern covering both relatively flat portion **21** and relatively curved portion **22** of film subcomponent **20** in the final finished part, a backing material is injection molded against inner surface **26** of film subcomponent **20** in a mold having a film-receiving surface with a three-dimensional texture to emboss a desired pattern into film subcomponent **20**. FIG. **4** is a front view of the embossed interior trim component **30** after injection molding. A consistent embossed pattern with a substantially uniform, undistorted appearance extends over relatively flat portion **31** and relatively curved portion **32** since the film subcomponent has already completed any stretching by the time it becomes embossed by pressing against the 3-D texture of the injection mold surface. As shown in cross-section in FIG. **5**, the embossed film subcomponent **20** acts as a covering appliqué of structural backing member **33**.

FIG. **6** shows the interior trim component in an injection mold apparatus having a core **35** and a cavity **36**. Cavity **36** has a film-receiving surface **37** with an embossment/textured surface. The textured surface may include a regular, grid-like pattern, graining, stippling, or graphics or logos as desired. An appliqué **40** becomes embossed with the pattern upon injection molding of backing member **41**. A curved section **42** of core **35** and cavity **36** corresponds to a deep draw contoured surface of appliqué **40**. A molten plastic backing material is injected via channels in a conventional manner (such as channel **43**) wherein pressure of the molten plastic material expands film subcomponent **40** against textured surface **37** to form an embossed pattern.

FIG. **7** illustrates another mold cavity **45** with a deep drawn contour section **46**. A consistent grid-like pattern is applied to the film-receiving surface at both a relatively curved portion **47** and a relatively flat portion **48**. The textured pattern may be created by laser etching, stamping, or other processes as known in the art.

FIG. **8** illustrates the finished trim component wherein a rear side **41** of the structural backing member includes bosses **50** and other support structures for interfacing with and connecting to various supports.

In addition to a consistent background surface treatment over substantially all of the trim component, the present invention may optionally use additional embossed features such as logos or other graphic patterns at either a relatively flat or relatively curved portion of the trimmed components. For the relatively flat portions where distortion of pre-printed graphics does not occur, then such printed graphics can also be utilized in the present invention either with or without corresponding embossed features.

As shown in FIGS. **9** and **10**, printed graphic features in a relatively flat portion may coincide with additional embossed

4

features. FIG. **9** shows a film-receiving surface **51** having a regular grid-like texturing (such as graining, stippling, or other treatments) along with a relief section **52** wherein other raised or lowered embossment features are contoured into the mold. FIG. **10** shows a film subcomponent **53** with preprinted graphics **54** that are embossed according to relief section **52**.

One preferred method of the invention is shown in FIG. **11**. A film subcomponent is molded with a deep draw section in step **60**. The film may preferably have a smooth outer surface and monotone pigmentation. A graphic with contrasting pigmentation may be printed on a flat portion of the film subcomponent in step **61**. Step **61** may alternately be performed prior to step **60** on the flat film sheet prior to molded of the film subcomponent. The film subcomponent is loaded into an injection mold in step **62**. In step **63**, molten plastic is injected into the mold against an inner surface of the film subcomponent. Pressure and heat of the injected plastic causes the film subcomponent to conform to the 3D texture of the film receiving surface of the mold resulting in the embossed pattern in step **64**. The trim component with an embossed pattern on the visible surface is cooled and ejected from the mold in step **65**. Thus, other than a provision of novel film receiving surface on the mold cavity, conventional molding processes and materials can be used in the present invention.

What is claimed is:

1. A plastic-molded automotive interior trim component having a curvilinear finished surface with a relatively flat portion and a relatively curved portion, comprising:

a decorative film subcomponent with an outer surface and an inner surface, wherein at least the outer surface is pigmented with a desired color of the finished surface, wherein prior to incorporation into the plastic molded component the decorative film subcomponent has a shape generally conforming to the curvilinear finished surface, and wherein prior to incorporation into the plastic molded component the outer surface is substantially smooth; and

a structural backing member which is in-mold laminated with the decorative film subcomponent, wherein the structural backing member is formed by injection molding a backing material against the inner surface of the decorative film subcomponent in a mold having a film-receiving surface having a three-dimensional texture that receives the decorative film subcomponent and shapes the decorative film subcomponent with an embossed pattern having a substantially uniform, undistorted appearance on at least part of the relatively flat portion and at least part of the relatively curved portion.

2. The component of claim **1** wherein the embossed pattern of the decorative film subcomponent is comprised of a regular, grid-like pattern repeating across substantially all of the outer surface.

3. The component of claim **1** wherein the relatively curved portion includes a deep draw contour.

4. The component of claim **1** wherein the three-dimensional texture includes a relief forming a graphic element at the relatively flat portion, and wherein the embossed pattern continues over the graphic element.

5. The component of claim **4** wherein the decorative film subcomponent further comprises a contrasting pigment on the substantially smooth outer surface at the relatively flat portion corresponding to the relief so that the graphic element has a distinctive color and three-dimensional texture.

6. An automotive vehicle interior trim structure comprising:

a plurality of abutting interior trim components each having a matched embossed pattern, wherein at least one

interior trim component has a curvilinear finished surface with a relatively flat portion and a relatively curved portion, and wherein the at least one interior trim component includes:

- a decorative film subcomponent with an outer surface 5
and an inner surface, wherein at least the outer surface is pigmented with a desired color of the finished surface, wherein prior to incorporation into the plastic molded component the decorative film subcomponent has a shape generally conforming to the curvilinear 10
finished surface, and wherein prior to incorporation into the plastic molded component the outer surface is substantially smooth; and
- a structural backing member which is in-mold laminated 15
with the decorative film subcomponent, wherein the structural backing member is formed by injection molding a backing material against the inner surface of the decorative film subcomponent in a mold having a film-receiving surface having a three-dimensional texture that receives the decorative film subcompo- 20
nent and shapes the decorative film subcomponent with an embossed pattern having a substantially uniform, undistorted appearance on at least part of the relatively flat portion and at least part of the relatively 25
curved portion.

* * * * *